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MapScholar: A Web Tool for Publishing Interactive Cartographic Collections

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Project Activities and Accomplishments

The MapScholar project commenced in September 2012 and was extended through August 2016. We have created a fully functional, open source HTML5 visualization tool built around the interpretive tasks of assembling collections of historic maps for analysis, arranging them in rich geospatial contexts, and presenting them to viewers in dynamic and interactive websites that we we call digital atlases. We have disseminated this tool and its productions in a variety of ways and will continue to do so. S. Max Edelson has presented MapScholar presentations to a number of academic and public audiences; and Edelson and Bill Ferster have created a digital humanities curriculum at the University of Virginia at the graduate and undergraduate level featuring MapScholar (and other instructors have made use of it at other universities). MapScholar will be showcased and publicized though Edelson's forthcoming trade publication: *The New Map of Empire: How Britain Imagined America before Independence* (Harvard University Press, 2017).

Edelson describes the origins, creation, and significance of these MapScholar visualizations in the book:

> The maps for this book are available online at http: // mapscholar.org / empire.
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> In 2007–2008, as the Kislak Fellow in American Studies, I examined the Library of Congress's remarkable collection of American manuscript maps. I found few that depicted the long-settled colonies, and many more that focused on the new territories acquired by Britain in 1763. I began the research behind this book to explain the intensive mapping of places such as Nova Scotia, Pensacola, and Dominica over places like Massachusetts, Philadelphia, and Virginia. Out of all proportion to their immediate commercial value and population, the attention of imperial officials as well as

metropolitan merchants focused on these frontiers to gauge the perils and promise of British America. Beyond the sheer number of images of remote rivers, islands, forts, coasts, boundaries, and sea-lanes in North America and the Caribbean, I was also struck by their shared graphic qualities. This common spatial sensibility, reflected in the style, scale, and detail of so many maps of such diverse, far-flung places, originated in the Board of Trade's vision for imperial expansion and reform, articulated in 1763. This body of images emerged from a long-standing view of America that took form in the halls of British power over the course of the eighteenth century and crystallized into an unprecedented project of state-controlled colonization.

As I studied the maps laid out for my inspection on the tables of the Geography and Map Division's reading room, I learned to see them as particular, regional expressions of a unified imperial vision of space and power. I also began experimenting with digital tools to share my visual experiences in the archives with a larger audience of readers. Map history has always been limited by the challenges of reproducing dense images printed or drawn on fragile paper artifacts. Working within the constraints of print technologies, scholars have privileged a few landmark works of distinction as the true subjects of the history of cartography, leaving aside the messy, scattered, and much larger manuscript record that occupies the pages of this book. The massive push by libraries to preserve collections through digitization has opened access to the rarest old maps, a development that, along with new interest in spatial humanities, is drawing innovation to a traditional field. By making new use of this growing digital map archive, I attempt to leave behind this artificial economy of image scarcity in map history publishing and embrace the profligate consumption of visual media so readily enabled by the World Wide Web and so well suited to appreciate the variety and quantity of images Britain produced to behold its expanding colonial world.

Mapmakers in the service of the British state produced thousands of images of America in the eighteenth century. I have curated a collection drawn from this enormous output to illustrate shifts in geographic ideas about America before 1763, to create a broad sample of the manuscript maps of the new territories drafted between the Seven Years' War and the American Revolution, and to show how some noteworthy published maps derived from these original images. The text references these maps by number within brackets, and the enumerated Map Bibliography provides full citations, including URL links to online resources maintained by the libraries and archives that hold them. Instead of attempting to publish reproductions of these maps in the glossy pages of a large trim-size edition, I have posted all 257 enumerated maps in this collection online. The best way to read this book is with a computer screen close at hand so that you can view the hundreds of maps, plans, and charts mentioned in its pages. The War of Independence relegated thousands of manuscript images from working documents of imperial development to the status of artifacts that have since been deposited at libraries and archives in the United Kingdom and the United States. A primary task of this book is to reassemble a representative sample of this cartographic corpus before your eyes so that you can see how Britain attempted to take command of America and how comprehensive, provocative, and serious this effort was.

I have created seven digital atlases, one for each of the book's chapters, that present these maps in sequence on MapScholar, a web-based HTML5 platform purpose-built for map history research and display. This open source tool makes use of the increasing availability of high-resolution digital copies of historic maps and the capacities of modern web browsers to draw together distributed text, images, and geospatial data into dynamic visualizations. Research Professor Bill Ferster and I created MapScholar at the University of Virginia's Sciences, Humanities, and Arts Network of Technological Initiatives (SHANTI) to enable a new mode of writing and reading map history. These digital atlases display historic maps overlaid onto a global basemap, a visual format that helps us see them less as independent expressions whose meanings are contained, like works of art, by the frames inscribed around their edges and more as

parts of a larger effort to generate a body of geographic information through surveying and mapmaking. Such visualizations provide a wider frame of reference for individual images, show multiple maps at the same time, and encourage comparisons between historic and modern representations of space. Georeferencing maps in this way also draws attention to differences in their scales of representation. Printed reproductions size maps to the space available on the page, a practice that flattens our appreciation of the sometimes vast distance between maps that depict towns, tracts, fields, and structures at "larger" scales and those maps that depict the broad sweep of colonies, regions, continents, hemispheres, and the globe itself at "smaller" scales. The lexicon of British mapmaking during this generation focused on each end of this spectrum of geographic representation. This pattern becomes visible by witnessing the jarring transitions between higher-resolution maps of small spaces and lower-resolution maps of large spaces, an experience simulated by following the navigation prompts programmed into MapScholar's digital viewer. The importance of scale in the spatial representation of American territories is thus a central concern of this book, and viewing the maps as objects that bear a defined relation to geographic space, as they appear on the website, underscores in visual terms the importance of scale to Britain's attempts to recolonize America.

By putting these maps online, organized and annotated to draw the reader's attention to details and contexts in high resolution, I hope to encourage an eighteenth-century mode of map viewing in which understanding (as well as pleasure) was to be gained by becoming immersed in mapped space, locating places described in texts, and forming views of unfamiliar parts of the world in the mind's eye. As you read this book, I encourage you to open these digital atlases and flip through their pages in sequence. Clicking on hyperlinked text and icons on any page will zoom in on details mentioned in the text and open supplemental material added to enhance and explicate it. In anticipation that this resource will, inevitably, degrade, I have posted the basic map images in more durable, if less vibrant, online repositories and appended a list that will allow future readers to locate the original maps, many more of which will be published online in the future by the archives that hold them.

The primary work of the final, extension year of the grant focused on obtaining scans and photographs of the original manuscript maps and using them to create these seven digital atlases. We hope that the book will draw readers to mapscholar.org and showcase the features we have built into MapScholar as well as demonstrate the potential for humanities scholarship of using it to assemble and display digital map collections.

The goals outlined in the application focused on designing an online interface for displaying geospatial visualizations featuring historic maps and creating a metadata wizard in collaboration with UVA digital humanities specialists. The interface we created features a large geospatial viewer in which historic maps are georeferenced and displayed on modern basemaps of the globe; a timeline at the bottom of the screen locates maps by year of creation; and a column displaying text, links, and metadata provide context for the visualizations and a structured means of interacting with the displayed images. Originally driven by a online

spreadsheets, we created MapEdit, an online metadata wizard to allow users to create and edit projects online via any web browser. MapEdit is a data aggregator that creates the basic units that we call Map Objects (MOBs) that drive every MapScholar visualization. It supports Startup MOBs that title the atlases and set their mode; Chapter and Header MOBs that allow atlas creators to organize content in collapsible folders and users to explore collected resources in Atlas mode; Choro MOBs that display numerical data associated with mapped elements; Goto MOBs that control navigation on the main viewer; Info MOBs that control the way text appears on an information panel; Layer MOBs that display KML layers; Link MOBs that display linked web content in a viewing box; Map MOBs that record image and metadata for maps displayed in the atlas; Sound MOBs that play audio clips; and Text mobs that generate a title page template and display text on the main viewer.

By launching MapEdit (http://viseyes.org/mapscholar/mapedit.htm#) in any web browser, users can create and save atlas projects and edit these MOBs to create the full range of designed MapScholar visualizations. Core metadata can be entered directly by using built-in text editors (which translates formatted text into HTML), the "Geo-reference" button (which allows the user to manually position the historic map on a basemap to generate geospatial coordinates), and the "Flickr-grabber" (which allows URLs for images loaded on the image-hosting site Flickr to be directly downloaded into a MOB). The "Copy to clipboard" function allows for the copying and pasting of MOBs among projects. A "Preview" button allows MapScholar creators to see the visualizations their MOBs define in the MapEdit viewing pane before saving the projects. Once saved, new edits to the MOBs are instantly updated and these changes are reflected in the published digital atlas. Users can mark projects as "private," thereby blocking access to their MapEdit content, but MOBs in all other projects can be copied by other users seeking to emulate visualizations in atlases they admire (although editing these visible atlases can only be done with the creator's log-in credentials). The small amount of data used to display the interface and record the metadata for individual atlas projects so entered is stored on a UVA server, while the larger image files are maintained at a third-party site controlled by the user.

MapScholar fulfills the original vision of the project to create a Design and Collection Tour tool, envisioned as a "tour module that allows scholars to control the navigation features in MapScholar to program a guided tour through map collections that will also feature audio

commentaries." We created three modes for users to interact with map collections online. Slide mode creates a basic PowerPoint-style presentation; Atlas mode allows users to explore map collections at the own interest and discretion by clicking on thumbnails the represent the collected MOB data for each map; and Book mode arranges this data into an creator-directed interactive display format that guides the user through a series of pages on which different MOBs are joined together. These Book mode atlases feature a title page template the pulls the author, title, and images into a preformatted design: a title-card to lead each digital atlas.

We set out to build an internal Georeferencer tool to allow users to associate historic maps with geospatial coordinates, and we did so: our Georeferencer allows users to visually match their maps to the global basemaps and automatically deposits these coordinates as metadata in a MapScholar MOB. We set out to "build an HTML5 tool . . . to enable graphic annotations linked to geospatial data to be generated, saved, and uploaded as a URL-ready image" and we did so: our Drawing tool allows users to create placemarkers, lines, and shapes-- with a variety of color and transparency options--and save these graphic annotations remotely. We originally thought to create a "Page Search tool," by which MapScholar visualizations could be linked with the pages of printed books. In the end, we opted for an interactive table of contents feature that allows direct links from the title page to any page within the atlas (as well as a URL format that can direct the reader to any particular page of an atlas). As anticipated, we created mapscholar.org to introduce users to the resource, showcase completed projects, and provide documentation to use MapScholar's functions and create digital atlases. In short, we believe we have fulfilled all of our stated goals for the project, either delivering on the functions that we originally envisioned or answering envisioned needs in new ways.

One of the goals for MapScholar was to create a browser-based, open source geospatial visualization tool that could emulate some of the visualizations typically created with proprietary ESRI products in a much less cumbersome and complex fashion. To this end, we developed a choropleth tool that does a few important things that have not been done before. First, it liberates data generated in ArcGIS--typically displayed as static visualizations--and enables it to be shared in a dynamic fashion online. Second, it provides a tool for the analysis of historical data that is geospatial. Instead of taking statistical results and visualizing them, this tool allows researchers and other users to see geospatial patterns as the object of analysis. Similarly, our

MapTiler javascript applet allows advanced users to generate tiles of especially high-resolution images (that is, those so large that they cannot be easily loaded as whole images for display in MapScholar from a third-party image hosting site such as Flickr). Mapscholar.org is the home for the resource and the portal through which new creators and users can come to find out more. It features documentation to "Discover" and "Build" digital atlases, a news stream, and a series of featured atlases created using the platform.

Audiences

The process of designing and creating MapScholar at UVA depended on the work of a number of history PhD students who helped build this platform and mastered its functions. Martin Öhman, Doug MacGregor, Rebecca Green, Lee Wilson, Andrew McGee, Jim Ambuske, Mary Draper, Ryan Bibler, Shane Lin, and Adele McInerney made significant contributions to this project as MapScholar research assistants. All of them have used this experience in integrate digital humanities into their work as college-level instructors, lawyers, or public historians. They constitute an important audience for this resource and have the potential to spread its use among students, scholars, and the general public at other institutions. Our partnership with UVA's Teaching and Technology Support Partners program helped showcase MapScholar on grounds.

MapScholar has become a robust teaching tool used at a number of universities. Students at the University of Central Florida and the University of Missouri-Kansas City used MapScholar in courses to develop historical data visualizations. We have worked with a number of scholars and digital humanities innovators to develop MapScholar solutions to their projects. We worked with the following: Miami University English professor Michelle Navakas for her research on the mapping of Florida; Louis-Pascal Rousseau on a site featuring maps of Quebec City; historian Philip D. Morgan at the Johns Hopkins University on a map archive of the early Caribbean; University of Missouri-Kansas City historical geographer Daniel Hopkins on the maps and censuses of the Danish island of St. Croix; and University of Virginia historian Waitman Beorn on the geographies of concentration camps. We consulted with data visualization expert Alberto Cairo and Stanford historian and DH developer Walter Schiedel to discuss the project and its development. We have met with a consortium of K-12 educators

organized by the Library of Virginia to use MapScholar to support a distance learning initiative on the history of slavery.

Edelson has presented MapScholar digital atlases at a variety of forums as it was being developed, including the Eighth Biennial Virginia Garrett Lectures on the History of Cartography at the University of Texas at Arlington, October 2012; meeting of the Washington Map Society, Library of Congress, Washington, DC, March 2013; the annual meeting of the American Historical Association in Washington, DC, January 2014; the symposium on "From Defining Lines to Lines of Control? Cartography and the British Empire" at the Borderwork(s) Humanities Lab at the Franklin Humanities Institute, Durham, NC, January 2014; the History Seminar at the Johns Hopkin University, Baltimore, MD, February 2014; Drayton Hall Distinguished Speakers Series, Charleston, SC, April 2014; the Annual Conference of the Omohundro Institute of Early American History and Culture in Halifax, Nova Scotia, June 2014; the Fry-Jefferson Map Society Lecture, Library of Virginia, Richmond, VA, October 2014; the first annual meeting of the Virginia Consortium of Early Americanists held at Virginia Commonwealth University, Richmond, VA, February 2015; conference on "Grassroots Modernities: Nature, Agriculture and Improvement in the Atlantic World," Center for the Study of Representative Institutions, Yale University, New Haven, CT, June 2015; the Omohundro Institution of Early American History and Culture THis Camp, Williamsburg, VA, October 2015; University of Virginia/University of Edinburgh Transatlantic Videoconference Seminar, Charlottesville, VA, November 2015; Ossawbaw Island Foundation Symposium on "Coastal Nature, Coastal Culture: Environmental Histories of the Georgia Coast," Savannah, GA, February 2016; Digital Humanities at the University of Virginia Conference, Charlottesville, VA, October 2016; Institute of the Humanities and Global Culture's Global South Colloquium, Charlottesville, VA, November 2016; and the Coastal Georgia Historical Society meeting, St. Simons, GA, November 2016.

Ferster and Edelson published "MapScholar: A Web Tool for Publishing Interactive Cartographic Collections" in *Journal of Map & Geography Libraries: Advances in Geospatial Information, Collections & Archives* to describe the origins of the project and especially its relevance for the new "spatial turn" in humanities research. Edelson published "MapScholar: A New Digital Tool for Displaying Map Collections Online" in the Winter 2015 issue of *The Portolan: Journal of the Washington Map Society*. MapScholar is listed as a resource in *The*

Arclight Guidebook to Media History and the Digital Humanities as well as on the *Map History/History of Cartography* website (http://www.maphistory.info/). It is featured in an episode of the "Savannah Podcast" at http://savannahpodcast.com/multimedia-archive/ utopian-dreams-hard-realities-in-early-georgia-maps/.

Our public presentations, publications, teaching, and workshops have attempted to showcase mapscholar and encourage its adoption by a wide range of users. We do not have a quantitative summary of this audience or its composition. We anticipate that the publication of Edelson's *The New Map of Empire* will produce a surge of user, reader, and media interest in the project that can be tracked to some degree by looking at traffic at the mapscholar.org website, which is light at the moment.

Evaluation

We have not formally evaluated MapScholar but rather presented the resource as it was being developed to partners, stakeholders, and audiences and used their feedback to refine the platform. Our weekly meetings with graduate research assistants and UVA visualization experts became problem-solving sessions in which changes were made to the software to address the needs of project developers as they arose. In our view, the proof of the pudding was in the eating, and we strove to satisfy our digital atlas creators to allow them to do what they wanted to do with MapScholar. We will continue this process of refinement as we partner with new digital atlas creators, especially for those graduate students working on individual research projects for Edelson's "Tutorial in Historical Digital Visualization" in Spring 2017 and beyond. This ad hoc, trial-and-error driven workshop approach to DH development was broadly effective, especially when technical challenges demanded dramatic new solutions.

The biggest challenge to MapScholar's development has been disruptions in commercially provided resources that became difficult to work with or unavailable, particularly the Google Earth API on which we built our initial visualization. First, a bug obstructed the visibility of layered images that we were able to resolve through contacts with Google's engineers. Second, Google deprecated its Earth API in December 2014. This unexpected change took place as we were developing the final features of MapScholar and preparing documentation and dissemination plans. These we scrapped in favor of a wholesale remounting of the webapp on OpenLayers, an open-source javascript library that provides the new global

basemaps for our resource. To make MapScholar work on OpenLayers, we needed to find a way to draw the various elements that make up MapScholar atlases (such as georeferenced maps, text and graphic annotations, layers, and links) onto the canvas that displays items in OpenLayers. We devised a number of new coding solutions to the challenge of displaying high-resolution tiled maps on the canvas during the final year of the grant period.

Continuation of the Project and Long-term Impact

Although we have designed MapScholar to be easy to use for those without special computing expertise, its wide range of features require patience and practice to produce good results. Because of this somewhat steep learning curve, few of our partnerships outside of UVA have yielded what we had originally hoped for: a robust community of atlas creators. To remedy this going forward, we will integrate MapScholar atlas development into formal coursework. Edelson will be teaching the first entirely MapScholar-focused course, "Digital Practicum in Map History," as a selective "Pavilion Seminar" designed to introduce advanced UVA undergraduates to pedagogically innovative experiences. This course is designed to partner with libraries and archives to digitize and develop digital atlases focused on interpreting important manuscript map collections. In Spring 2017 we will partner with the William L. Clements Library at the University of Michigan to produce a digital atlas of the Murray Map Collection. Consisting of approximately 75 individual images, the Murray Maps were created by the British Army in Canada in 1760 and 1761 to record the people and places of what had been New France and what would become the British colony of Quebec. The images sit at the crux of a number of important developments in the early modern world, including settler colonialism, indigenous land rights, Enlightenment statecraft, and the creation of one of the first "polyglot" empires that would soon characterize modern global imperialism. As students georeference maps, design dynamic visualizations, record object metadata, manage distributed web resources, and write essays and annotations that provide context and interpretation, they will gain first-hand experience in digital humanities work. We will meet via videoconference with Clements librarians to build a resource that will best serve the broader public they aim to reach. Future offering of this course will focus on indigenous cartographies and the visual record of the "global south" in tandem with a the current Mellon-foundation funded Global South Lab at the Institution of the Humanities and Global Cultures at UVA.

Through such coursework, we will introduce students to digital humanities and geospatial visualization and produce resources at that reach a broader public in association with partner repositories. We will continue to develop MapScholar at SHANTI, especially to integrate MapScholar with its suite of visualization tools offer by SHANTI Interactive (see http://www.viseyes.org/). MapScholar and S. Max Edelson's expertise as a faculty fellow were featured in the application to create UVA's Global South Lab, an initiative funded through a $3.47 million grant from the Andrew W. Mellon Foundation to promote the study and teaching of the Global South at UVA. Our public presentation have, we think, contributed to maintaining UVA's strong reputation in Digital Humanities research.

Grant Products

Products produced during the grant period include our website, www.mapscholar.org. Digital atlases include: "The Territorial Pattern of Settler Populations in North America, 1620-1790," http://www.viseyes.org/mapscholar/?776; "Taking the Spatial Turn: Digital Tools for Visualizing Early American Maps," http://www.viseyes.org/mapscholar/?291; "Visualizing Early America: Three Maps that Reveal the New World," http://www.mapscholar.org/3maps; and "Mapping Carolina: Cartography and the Quest for Empire in the Colonial Southeast," http://mapscholar.org/mapping_carolina; "Mapping the 'Whole Coast': Territory, Cartography, and the Problem of Scale in British America, 1763-1775," http://mapscholar.org/wholecoast; And "Defining Carolina: Cartography and Colonization in the North American Southeast, 1657-1733," http://mapscholar.org/carolina. Digital atlases featured in Edelson's *The New Map of Empire* are or will be posted at www.mapscholar.org/empire. See Harvard University Press's book website here: http://www.hup.harvard.edu/catalog.php?isbn=9780674972117.